



Taxonomic Review of Korean Eumenine Wasp Genus *Symmorphus* Wesmael (Eumeninae: Vespidae: Hymenoptera)

Jeong Kyu Kim* and Seung Gil Lee¹⁾

Korean Entomological Institute, Korea University, Seoul 136–701, Korea

E-mail: kwasp@chollian.net

¹⁾Department of Biology, Faculty of Science, Hanseo University, Seosan-shi, Chungcheongnam-do 356–706, Korea

Abstract Korean *Symmorphus* species are reviewed taxonomically. We have confirmed eleven species including six newly recorded ones from the Korean Peninsula: *Symmorphus ambotretus*, *S. angustatus*, *S. apiciornatus*, *S. bifasciatus*, *S. carinatus*, *S. decens*, *S. foveolatus*, *S. lucens*, *S. mizuhonis*, *S. murarius*, *S. tsushmanus*. A key, diagnosis, remark and illustrations to all the known species are provided.

Key words Taxonomy, Korean Peninsula

INTRODUCTION

As one of the serial works for completing the reference on Korean eumenine wasps, genus *Symmorphus* Wesmael is reviewed taxonomically. About thirty six species have been recognized worldwide (Cumming, 1989), and six species have been known from the Korean Peninsula (Yasumatsu, 1938; Kim, 1970, 1980; Giordani Soika, 1975; Tsuneki, 1986; Cumming, 1989; Yamane, 1990; Kurzenko, 1995; Kim and Yoon, 1996): *S. angustatus*, *S. apiciornatus*, *S. bifasciatus*, *S. captivus*, *S. foveolatus*, *S. mizuhonis*. However, the previous records of *S. captivus* have been revealed the misidentification of *S. foveolatus*, i.e., the record of Yasumatsu (1938) by Giordani Soika (1975), and that of Kim (1970, 1980) by authors herein. As a result we have confirmed eleven species including six unrecorded ones from the Korean Peninsula. A key, further diagnoses, remarks and illustrations to all the known species are provided in this study.

MATERIALS AND METHODS

This study is based on the materials accumulated in major hymenopteran collections in Korea as follows: Korean Entomological Institute, Korea University, Seoul; Dept. of Biology, Gyeongsang National Univ., Jinju; Dept. of Biology, Sungshin women's Univ., Seoul; Dept. of Biology, Yeungnam Univ., Kyeongsan. To ensure the identification, the materials from adjacent regions (Japan, Far Eastern Russia) were also used.

In the section of species enumeration, synonym lists include the original record and later ones only referred to the Korean Peninsula. All the species are described with additional diagnoses and taxonomic remarks.

* To whom correspondence should be addressed.

The abbreviated provincial names are used instead of administrative ones in full as follows: SL (Seoul), GG (Gyeonggi-do), GW (Gangweon-do), CB (Chungcheongbuk-do), CN (Chungcheongnam-do), GB (Gyeongsangbuk-do), GN (Gyeongsangnam-do), JB (Jeonrabuk-do), JN (Jeonranam-do), JJ (Is. Jeju-do).

SYSTEMATIC ACCOUNTS

Genus *Symmorphus* Wesmael 앞벌레살이감탕벌속

Symmorphus Wesmael, 1836, Bull. Acad. R. Belg. 3: 45 (Subgenus of *Odynerus* Latreille) (dating from Carpenter 1986); Vecht and Fischer, 1972: 118; Carpenter, 1986: 86; Cumming, 1989: 13–15; Vecht and Carpenter, 1990: 56.

Genotype species. *Odynerus elegans* Wesmael, designated by Richard, 1935.

Distribution. Nearctic, Neotropic, Oriental, Palearctic

Genus *Symmorphus* is easily separable from the other genera by the following character combination: well developed notaulix through the whole length of mesonotum, and presence of both a basal transverse carina and a dorsomedian longitudinal depression bearing a medial longitudinal furrow in post-carinal area of tergum I.

General diagnoses are as follows. Body is small to medium-sized, less than 15 mm from head to metasomal segment II. In female, a pair of cephalic foveal pits (cfp, Fig. 43) present, and in some forms cephalic fovea (cf, Fig. 24) bearing cfp is also present. Epipleural suture is well developed and deeply foveolated (Fig. 5). Epicnemial carina (ec, Fig. 9) is usually well developed, but absent in some forms. Propodeum has a distinct dorsomedial pit. Metasomal segment I is subsessile, and rather slender than segment II. Sternum I has at least lateral carina (In some forms, basal, longitudinal and lateral carinae well developed. However, depending on the species, carinal state is very variable). Metasomal terga II–IV (V) are usually almost impunctate and shining. In male the last antennal segment is normal, not hooked.

Key to the known species from the Korean Peninsula

1. Occipital carina with two submedial incisions delimiting a medial tubercle (Fig. 1, arrow). Tergum II obtusely angled basally, and sternum II abruptly truncate behind the basal sulcus (Fig. 2). Tergum II, seen from above, elongated, three times as long as the post-carinal medial length of tergum I (Fig. 3) *S. ambotretus* Cumming
- Occipital carina without such submedial incision. Metasomal segment II rounded basally in profile. Tergum II at most twice the post-carinal medial length of tergum I 2
2. Clypeus broadly and shallowly emarginated on apical margin (almost straight between apical teeth), and the apical teeth spaced by more than the inter-antennal socket length in both sexes (Figs. 7 and 8) *S. decens* (Kostylev)
- Clypeus moderately or narrowly emarginated, and apical teeth spaced at most by the inter-antennal socket length (Even if the apical emargination of clypeus very shallow, it is circularly emarginated, not straightened between tooth) 3
3. Mesosoma with sparse to moderately distributed long hairs in addition to densely distributed short hairs (Fig. 19). Basal carina on sternum I absent (Figs. 22 and 34) or incompletely developed only at lower part (Fig. 15) 4
- Mesosoma with only densely distributed uniform short hairs. Basal, lateral and longitudinal carinae on sternum I well developed (Figs. 45, 49, 58, 63 and 72) 7
4. Lower posterolateral propodeal portion where valvula and submarginal carina fused pro-

- minently processed. Tergum I with a triangular edge (or extending as short longitudinal carina) originating from transverse carina on dorsomedial part (Fig. 14). Ventral and dorsal mesepisternum fine with sparsely distributed punctures (Fig. 16) *S. mizuhonis* Tsuneki
- Propodeal valvula not pointed dorsally but somewhat rounded. Basal transverse carina of tergum I not processed dorsomedially, and obsolete at least on lateral portion. Ventral and dorsal mesepisternum coarse with very densely distributed, larger major punctures (Fig. 19) 5
5. Epipleuron without epicnemial carina (Fig. 19). Anterior portion of tergum I gradually sloped, in profile pre-carinal area as long as the post-carinal area (Fig. 20). Male antenna without distinct tyloid, at most the last two segments widely yellow-colored swollen parts (Fig. 21) *S. foveolatus* Gussakovskij
- Epipleuron with distinct epicnemial carina. Anterior portion of metasomal tergum I abruptly sloped, in profile pre-carinal area rather shorter than post-carinal area. Male antenna with distinct tyloids 6
6. Large cephalic foveal depression present (Fig. 25) in female. Basal transverse carina on tergum I obsolete throughout the width (Fig. 27). Almost entire lateral face of propodeum areolated (Fig. 28). Dorsomedial pit on propodeum without inner carina (Fig. 29). The last segment of male antenna longer and more slender, the ratio of apical width/length approximately 1.5 (Fig. 26) *S. murarius* (Linnaeus)
- Cephalic fovea absent in female (Fig. 37). Basal transverse carina on tergum I distinct throughout the width (Fig. 33). Lateral face of propodeum finely striated (or carinate) at least near the metanotum (Fig. 35). Dorsomedial pit on propodeal shelf with concentric carinae (Fig. 36). The last segment of male antenna shorter and stouter, the ratio of apical width/length approximately 1.2 (Fig. 38) *S. angustatus* (Zetterstedt)
7. Medial longitudinal furrow on tergum I distinct throughout the length (Fig. 41). Tergum I with very sparsely distributed, small (rather smaller than the cephalic foveal pit) punctures, at most slightly denser in the longitudinally depressed median portion (Fig. 41). Cephalic foveal pit almost as large as the posterior ocellus (Fig. 43). Dorsal mesepisternum almost impunctate (only microscopically punctate), at most with very few small punctures (Fig. 42) *S. lucens* (Kostylev)
- Medial longitudinal furrow on tergum I indistinct or shorter. Punctures on tergum I with very dense (often areolate-rugous in the median longitudinally depressed portion) and large (as large as the cephalic fovea at least in the longitudinally depressed median portion) throughout the whole face (Figs. 48, 52, 62 and 70). Cephalic foveal pit usually smaller than the posterior ocellus. Dorsal mesepisternum at least with a few major punctures 8
8. Medial longitudinal carina on sternum I developed beyond the basal carina (Fig. 49, arrow). Epimeron densely punctate and at least partially areolate-rugous (Fig. 50). Tergum I, seen from above, strongly convergent toward base, the ratio of the width of carinal area/the apex width less than 0.65 (Fig. 48) *S. bifasciatus* Tsuneki
- Medial longitudinal carina on sternum I not over the basal carina. Epimeron with sparsely distributed punctures that are spaced at least by the diameter of the puncture (Figs. 56 and 64). Tergum I, seen from above, less convergent, the width of carinal area/the apex width more than 0.73 9
9. (in male) Lateral carina on sternum I meet medial longitudinal carina at separating lower portion from basal carina (so that the basal and lateral carinae not directly meet) (Fig. 58, arrow). Major punctures on mesonotum densely (almost touching one another) and regularly distributed. Lateral face of propodeum shiny, with distinct striae (or fine carinae) and large punctures (Fig. 57). Clypeus very shallowly emarginated *S. tsushmanus* Yamane

- (in both sexes) Basal carina and lateral carinae directly connected (Figs 63 and 72). Major punctures of mesonotum sparser (spaced by more than puncture diameter) and irregularly distributed. Lateral face of propodeum dull, with fine striae and weak punctures (Figs. 65 and 73). Clypeus moderately emarginated 10
- 10. Anterior slope of tergum I with a medial carina extended to mid length (Fig. 62, arrow). Transverse carina on tergum I protrude somewhat triangularly on dorsomedian part. Propodeal shelf well discernible, the length of submedial part a little more than half as long as the posterior vertical face of scutellum. Dorsomedial pit of propodeum large and round (Fig. 67) *S. carinatus* Yamane
- Anterior slope of tergum I without such medial carina. Transverse carina on tergum I triangularly incised on dorsomedian part (Fig. 71). Propodeal shelf very short, the length of the submedial part about 1/3 as long as the posterior vertical face of scutellum. Dorsomedial pit of propodeum small and often slit-like (Fig. 75) *S. apiciornatus* (Cameron)

ENUMERATION OF SPECIES

Symmorphus ambotretus Cumming 각진잎벌레살이감탕벌 (신칭)

Symmorphus ambotretus Cumming, 1989: 21, 26-28, 30, 97, 98, 105

Diagnosis. Of the known *Symmorphus* species, only this species has submedial two incisions on occipital carina. Cephalic foveal pit half as large as the posterior ocellus. Cephalic fovea and carina absent. Mesonotum and scutellum with both densely distributed minor and medium-sized major punctures, with which are not touching one another. Mesepisternum with sparsely distributed punctures (Fig. 5). Lateral face of propodeum shiny, and carinate to areolate marginally. Propodeal medial pit transversely excavate, almost rectangular-shaped. Transverse carina on tergum I well developed both dorsally and laterally (Figs. 2 and 3). Basal, medial longitudinal and lateral carina of sternum I well developed (Fig. 4). Tergum I with densely distributed large punctures (Fig. 5). Medial longitudinal furrow on tergum I evanescent. Lateral marginal side of tergum I, seen from above, almost parallel. Male with obvious tyloids in the last 4 segments (Fig. 6).

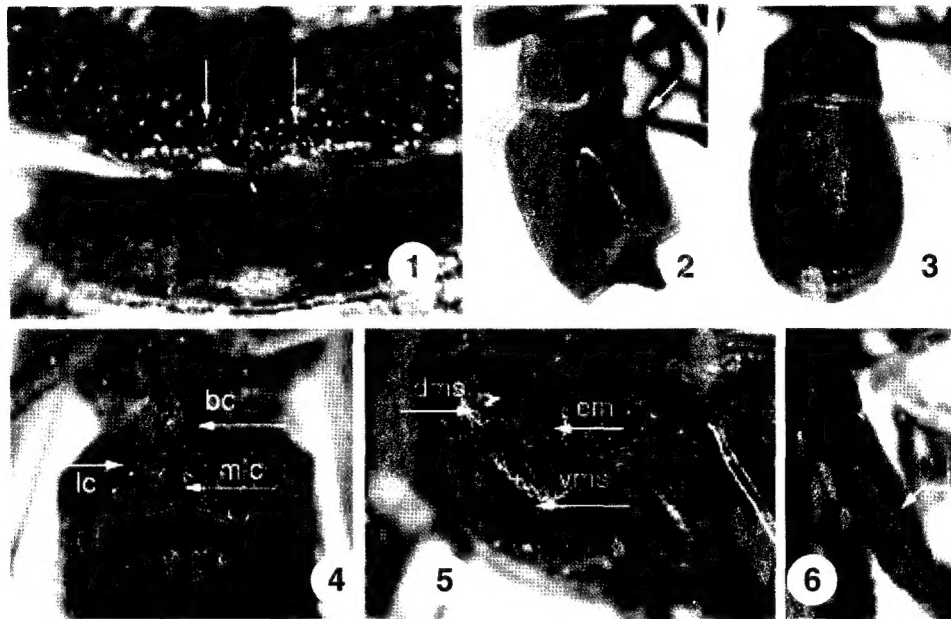
Materials examined. Korea: SL Uidong, 20 VI 1960, 27 VI 1960, WJ Kim, 8 ♀; Mt. Dobong, 25 VI 1983, HC Park, YS Song, 3 ♀. GG Kwangmyeong-shi, 7 VI 1986, HM Kim ♀. CN Mt. Gaya, Seosan, 12 VI 1997, MS Lee, ♀. GB Mt. Seondal, Bonghwa-gun Eojeon-ri, 3 VII 1998, JK Kim, ♂; Mt. Eorae, Bonghwa-gun Namdae-ri, 30 VI 1998, JK Kim, ♂; Keumsu-myeon Seongju-gun, 7 VII 1998, JD Yeo, ♀. Specimens other than Korean peninsula: Kathmandu, Nepal, 22 IV 1968, T Matsumura, ♂.

Distribution. Nepal (Kathmandu), China (Chichuan Prov. Chengdu), Korea (new record).

Symmorphus decens (Kostylev) 이마방패잎벌레살이감탕벌 (신칭)

Odynerus (*Odynerus*) *decens* Kostylev, 1940 : 40.

Diagnosis. The very shallow, wide and truncated clypeal emargination is peculiar as in the key. Clypeus is transverse in both sexes: In female almost twice wider than long if the lateral lobes included (Fig. 7), and more than 1.5 times in male (Fig. 8). Cephalic foveal pit very small, and cephalic foveal carina discernable (Fig. 12). Entire face of mesepisternum, mesonotum and scutellum with densely distributed (touching one another) uniform punctures (Figs. 8 and 9). Metapleuron and lateral face of propodeum dull and finely striate (Fig. 9).



Figs. 1–6. *Symmorphus ambotretus*. 1, Two submedial incisions on occipital carina. 2, Metasomal segments I and II showing basal angle, in profile. 3, Metasomal terga I and II, dorsal view. 4, Sternum I showing carinal development (bc, basal carina; lc, lateral carina; mlc, medial longitudinal carina). 5, lateral face of meso- and meta thorax. 6, male antenna.

Epicnemial carina absent in female, but present in male (Fig. 10). Metasomal sternum I without basal carina. Medial longitudinal furrow on tergum I throughout the length. Male antenna with tyloids (not keeled but widely swollen) in the last 5 segments (fig.13). The last segment of male antenna slightly shorter than the preceding segment.

Materials examined. Korea: GW Maehwadong, Mt. Bangtae, Inje-gun, 26 VI 1996, JW Lee, ♂. GN Pyochungsa (temp.), Milyang-shi, 7 VI 1995, YI Ban, ♂. CN Mt. Gyeryong, 7 VI 1997, SH Jeong, ♂. CB Mt. Namsan, Chungji-shi, 18 V 2001, JD Yeo, ♀. JN Mt. Duryun, 28 V 1993, JK Kim, ♂. Specimens other than Korean peninsula: Russia Lazevskij, Primorskij Krai, 1982, T Romanikova, ♂ ♀, Japan Kabatoketogenea Tokio, Japan, 22 V 1946, S Sagagami, ♂; Tatsuno Hyogo-ken, Honshu, Japan, 24 V 1994, ♀; Sado Is., Niigata-ken, Japan, 9 V 1986, T Onuma, ♀; Godaisan, Kochi-shi, Kochi-ken, Japan, 6 V 1976, S Ikudome, ♂.

Distribution. Russia (Primorskij Krai), Korea (new record), Japan.

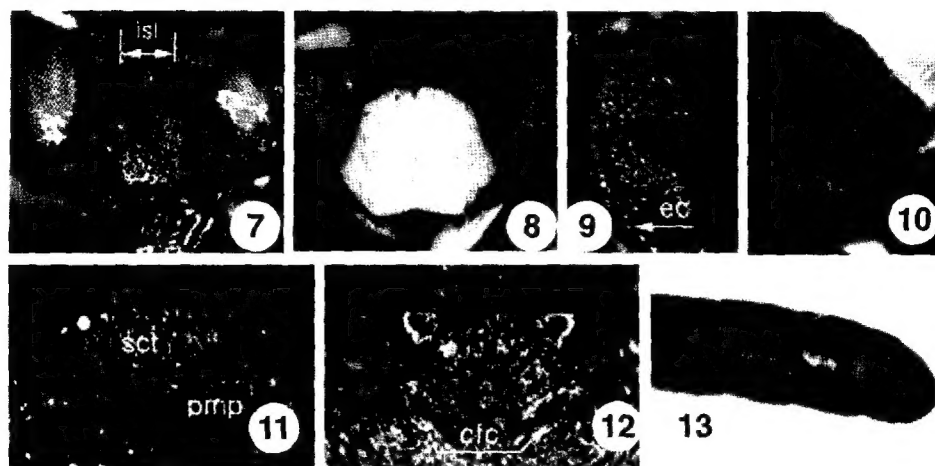
Symmorphus mizuhonis Tsuneki 북방잎벌레살이감탕벌

Symmorphus mizuhonis Tsuneki, 1977: 17–20; Cumming, 1989: 54–55; Kurzenko, 1995: 316; Kim and Yoon, 1996: 205.

Symmorphus iiyamai Tsuneki, 1986: 25–27 (♂, Mt. Baekdu, “North Korea, Mt. Hakuto, Jimmudjo”), synonymized by Cumming 1989.

Symmorphus shiroyamai Tsuneki, 1986: 25–27 (♂, Namseolryeong, “North Korea, Kankto-Hokudo, Haku-gan, Mt. Nansetsurei”), synonymized by Cumming 1989.

Symmorphus piceannus Tsuneki, 1986: 25–27 (♂, “North Korea, Mt. Hakuto, Jimmudjo”), synonymized by Cumming 1989.



Figs. 7-13. *Symmorphus decens*. 7, Clypeus, female (isl, interantennal socket length). 8, Clypeus, male. 9, Mesepisternum, male (ec, epicnemial carina). 10, Lateral face of propodeum. 11, Posterior vertical face of scutellum and dorsomedian part of propodeum (sct, scutellum; pmp, propodeal dorsomedian pit). 12, Median vertex area (cfc, cephalic foveal carina). 13, Male antenna.

Symmorphus sassai Tsuneki, 1986: 25-27, (♂, "North Korea, Mt. Hakuto, Jimmudjo"), synonymized by Cumming 1989.

Diagnosis. Basal transverse carina on tergum I well developed and somewhat sinuate dorsally, and peculiarly edged dorsomedially as in the key. Cephalic foveal pit very small, about 1/3 as large as the posterior ocellus, and cephalic fovea absent. Notaulix somewhat evanescent in the mid length. Mesonotum with densely distributed minor punctures and moderately distributed major punctures. Propodeal median pit deep, large and round. Tergum I with sparsely distributed medium-sized punctures except slightly larger and denser ones around the medial longitudinal furrow (Fig. 14). Medial longitudinal furrow of tergum I distinct throughout the length (Fig. 14). Basal carina on sternum I absent, but lateral and medial longitudinal carinae well developed (Fig. 15). Lateral face of propodeum shiny, and carinate anteriorly and areolate posteriorly (Fig. 17). Based on Russian and Japanese materials, the last segment of male antenna very small and short, almost half as long as the preceding segment. Male antenna with obvious tyloids in the last 3 segments (Fig. 18).

Remark. So far this species has been reported from northern part of the Korean Peninsula.

Materials examined. Korea: GW Mt. Bangtae, Jingdong-ri Inje-gun, 20 VI 1998, JK Kim, 2 ♀. Specimens other than Korean Peninsula: Russia Anisinovki Primoskij Krai, 14 VII 1974, A Berezantsev, ♀; Ussurka, 40 km E. of Melnichnoe, Primoskij Krai, 31 VII 1986, N Kurzenko, ♂; SE. Baikal, Bolshie Koty, 2 VIII 1983, P Nemkov, ♀; Lazovskij zapovedi, Primoskij Krai, 1983, T Romanikova, ♂. Japan Okunasu Tochigi, Honshu, Japan, 26 VII 1970, T Nambu, ♀, ♂ (Paratype, Kagoshima University); Yuzawa T., Niigata-ken, Japan, 8 VIII 1966, H Itami, ♀, ♂; Migimata-dani (1500-2000 alt.), Mts. Hida, Gifu-ken, Japan, 7/8 VII 1987, Y Takai, ♀.

Distribution. Western Siberia to the Altai, China, north and middle mountainous region of the Korean Peninsula, Japan (Honshu), Taiwan.



Figs. 14–18. *Symmorphus mizuhonis*. 14, Tergum I, dorsal view. 15, Sternum I. 16, Mesepisternum. 17, Lateral face of propodeum. 18, Male antenna.

***Symmorphus foveolatus* Gussakovskij 긴잎벌레살이감탕벌**

Symmorphus foveolatus Gussakovskij, 1933, Ark. Zool. 24 A (10):55 (dating from Cumming 1989); Tsuneki, 1986: 27 (10 ♀ 3 ♂, Seoul); Cumming, 1989: 23, 35–36; Yamane, 1990: 116–118; Kurzenko, 1995: 317; Kim and Yoon, 1996: 205.

Symmorphus captivus Smith: Yasumatsu, 1938: 11; Kim, 1970: 554, misidentification; Kim, 1980: 116, misidentification.

Diagnosis. Of the Korean species pre-carinal area of tergum I is the most gradually sloped (Fig. 20). Cephal foveal pit slightly smaller than the posterior ocellus, and wide shallow cephalic fovea discernable (Fig. 24). In both sexes, the epicnemial carina absent. Lateral face of propodeum dull and compactly striated only with sparsely distributed shallow punctures. Medial longitudinal furrow on tergum I distinct throughout the length. Basal transverse carina on tergum I obsolete in lateral part (Fig. 20). Propodeal medial pit long oval shape. Post-carinal area with densely distributed very large punctures. Sternum I areolate without typical carina (Fig. 22). Last segment of male antenna slightly longer than the preceding segment (Fig. 21).

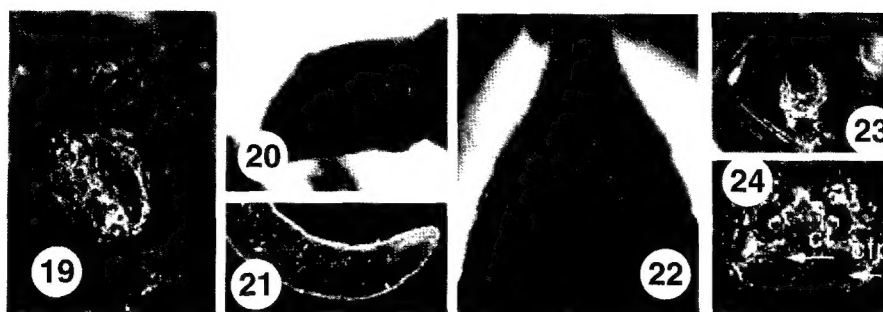
Remark. Although we failed to find all the specimens used by Kim (1970, 1980) in Korean record of *S. captivus*, several specimens including two voucher ones that were designated in his works were examined. All those specimens were identified as this species.

Material Examined. Korea: SL “Seiryori” (Cheongryangri), 24 V 1928, J Murayama, 2 ♀; Ui-dong, 6 VI 1960, WJ Kim, 18 ♀; same locality, 26 V 1961, WJ Kim, 12 ♂, 25 ♀; Korea University campus, 30 VI 1986, KS Yoon, ♀; Mt. Cheonggye, 28 V 1989, SH Yun, ♀. GG Baekam, Aseong-ri Yongin-shi, nesting in bamboo trap in 1999, emerging out in 2000, 4 ♀, 3 ♂. GW Hyanglobong, 16 VI 1968, JI Kim, ♀; Mt. Seolak Baekdamsa, 5 VI 1979, YJ Cha, ♀; Mt. Balgyo, Eoron-ri Hongcheon-gun, 23 V 1998, YG Park, MR Kim, JD Yeo, 6 ♀. GW Mt. Hwaak, Sanae Hwacheon-gun, 30 V 1998, 3 ♀; Mt. Bangtae, Jingdong-ri Inje-gun, VI 20 1998, JK Kim, ♀. Misiryeong Mt. Seolak, 20 V 2001, JD Yeo, ♀. CN Taejeon-shi Changdong 2-gu, 20, 25 V 1995, P Tripotin, 2 ♀. GB Mt. Hwanghak, 2 VIII 1978, HS Lee, 1 ♀; Mt. Sudo, Kimcheon-shi, 6 VII 1998, JD Yeo, ♀. JB Mujugucheondong, 10 VI 1972, JH Yu, ♀. Specimens other than Korean peninsula: Russia Lazovskij zapovedi, Primoskij Krai, 1981, T Romanikova, 2 ♀, 2 ♂; 40 km E of Ussurijsk, Ussurijsk reserve (140–160 m alt.), S. Primoskij Krai, 17 VII 1990, Sk Yamane, 2 ♀. Japan Ohsuidani, Shiraminemura, Ishikawa-ken, Japan, 26 VII 1990, 20 VI 1991, I Togashi, 2 ♀, 2 ♂.

Distribution. Russia (eastern Siberia), Korea, Japan.

***Symmorphus murarius* (Linnaeus) 줄무늬잎벌레살이감탕벌 (신칭)**

Vespa muraria Linnaeus, 1758.



Figs. 19–24. *Symmorphus foveolatus*. 19, Mesepisternum with long hairs. 20, Metasomal segment I, in profile, showing gradual sloping in anterior portion (cf, fig. 2). 21, Male antenna. 22, Sternum I. 23, Clypeus, female. 24, Vertex area showing cephalic fovea (cf) and pits.

Symmorphus murarius (Linnaeus): Cumming, 1989: 23, 33–35.

Diagnosis. In female the very wide cephalic fovea with dense long hairs is distinct. In male the ratio of the last antennal segment is also unique as in the key. The last 4 segments of male antenna with obvious tyloids (Fig. 26). In both sexes medial longitudinal furrow distinct in 2/3, or a little more, of the tergum I (Fig. 27). Mesonotum coarse with irregularly distributed major and minor (not microscopic) punctures. Mesopleuron with densely distributed large punctures. Propodeal medial pit round (Fig. 29). Clypeus as figures 30 and 31.

Materials examined. Korea: GG Kwangleung, 19 V 1974, H Namgung, ♂. Specimens other than Korean peninsula: Russia Lazovskij zapovedi, Primorskij Krai, 1983, T Romanikova, ♀. Kazakhstan 9–12 km W of Ajaguza, 19 VII 1986, V Kazenas, ♂; 25 km W of Almaati, 12 VI 1979, N Kurzenko, ♀.

Distribution. Continental Europe to Primorskij Krai in eastern Russia and Korea (new record).

Symmorphus angustatus (Zetterstedt) 가는잎벌레살이감탕벌

Odynerus angustatus Zettermann, 1838, insect. Lappon. 1: 457 (dating from Cumming 1989).

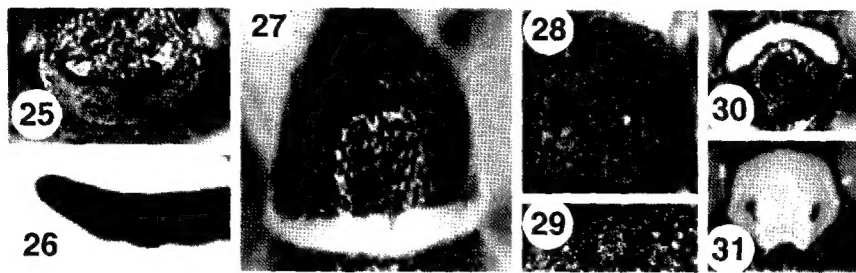
Symmorphus angustatus Zettermann: Cumming, 1989: 44–47; Kurzenko, 1995: 318; Kim and Yoon, 1996: 204.

Symmorphus hakutozanus Tsuneki, 1986: 23–24, 26 (♀ ♂, North Korea, “Mt. Hakuto, Jimmudjo”), synonymized by Cumming 1989.

Symmorphus nansetsurei Tsuneki, 1986: 26, 27 (♂, North Korea, “Kankyo-hokudo, Hakugan, Mt. Nansetsurei”), synonymized by Cumming 1989.

Diagnosis. Cephalic foveal pit half as large as the posterior ocellus (Fig. 37). Cephalic foveal carina obsolete. Clypeus as figures 39 and 40. Mesonotum and scutellum coarse with major and minor punctures irregularly mixed. Mesepisternum coarse, with irregularly distributed punctures. Dorsomedial pit of propodeum semicircular with concentric carinae. Tergum I with large punctures densely distributed (Fig. 33). Medial longitudinal furrow on tergum I confined to posterior 1/3 or 1/4. Male with tyloids in the last 5 segments: the ones on segments 10–13 obvious but obscure on segment 9 (Fig. 38).

Remark. This species is very similar to *S. captivus* (Smith, 1873) in many diagnostic features, but can be separated by the shape of post-carinal area of tergum I. In *angustatus*, lateral marginal sides on post-carinal area of tergum I, seen from above, somewhat convergent



Figs. 25–31. *Symmorphus murarius*. 25, Median vertex area with very wide cephalic fovea. 26, Male antenna. 27, Tergum I showing obsolete basal transverse carina. 28, Lateral face of propodeum. 29, Dorsomedial pit on propodeum. 30, Clypeus, female. 31, Clypeus, male.

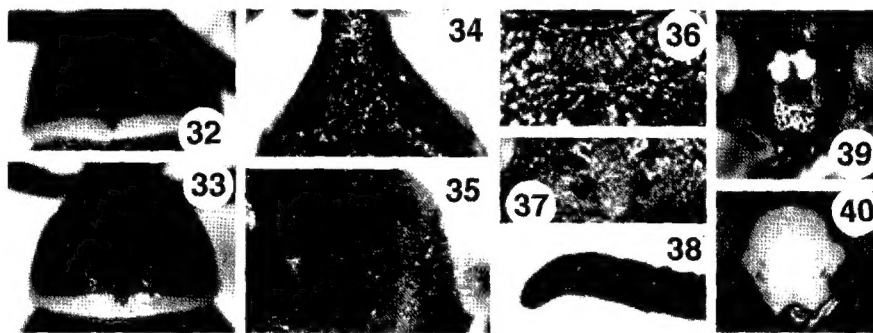


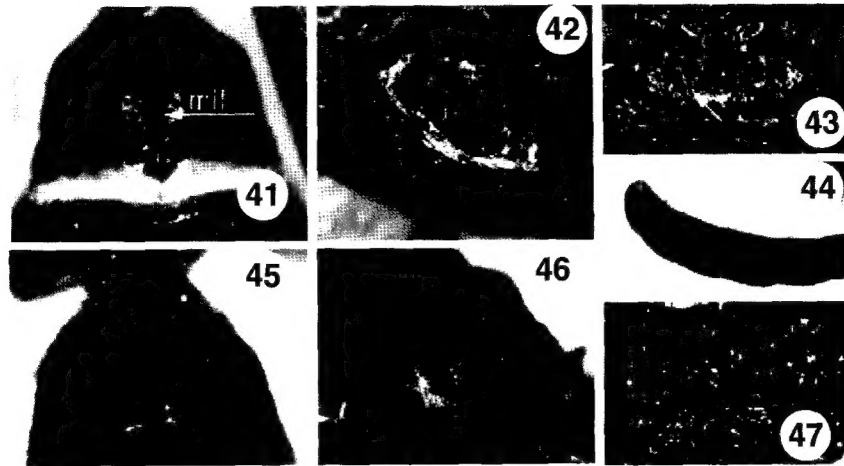
Fig. 32. *Symmorphus captivus*, Tergum I, dorsal view.

Figs. 33–40. *Symmorphus angustatus*. 33, Tergum I, dorsal view. 34, Sternum I. 35, Lateral face of propodeum. 36, Dorsomedial pit on propodeum. 37, Median vertex area. 38, Male antenna. 39, Clypeus, female. 40, Clypeus, male.

toward base, the ratio of width at transverse carina/width of apex less than 0.75 (Fig. 33). And in *captivus* it is less convergent and the ratio more than 0.80 (Fig. 32).

So far this species has been reported from northern part of the Korean Peninsula.

Material examined. Korea: SL Mt. Surak, 8 VI 1986, S.J.H., ♀; Mt. Surak, 27 VI 1986, L.H.C., ♂; Weonji-dong, 1 VI 1985, KS Jang, ♀; Mt. Cheonggye, 3 VI 1989, MJ Kim, ♀. GG Pyeongnae Mt. Cheonma, 2 VI 1984, GS Park, ♀; Ilyoung, 15 VI 1988, SY Jeong, ♀; Bokwang temple, 15 V 1988, JH Jeong, ♀; Cheongpyeong, 4 VI 1989, SH Lim, ♀. GW Hyanglobong, 16 VI 1968, JI Kim, ♀; Chunseong-gun Cheongpyeong-ri, 5 V 1989, EM Lee, ♀. CN Mt. Kyeryong, Gapsa (temple), 26 V 1974, HY Kang, ♀; Mt Gaya, Seosan-shi, 13 V 1997, WK Jeong, ♀. GB Mt. Hwanghak, 2 VI 1978, HS Lee, ♀; Kyeongsan Youngnam University campus, 17 V 1989, SY Jeong, ♂. Specimens other than Korean peninsula: Russia 25 km SE Ussurijsk, Ussurijsk reserve (100–140 m alt.) S. Primoskij Krai, 12, 14 VII 1990, Sk Yamane, 2 ♀; 40 km E of Ussurijsk, Ussurijsk reserve (140–160 m alt.), S. Primoskij Krai, 17 VII 1990, Sk Yamane, ♂; 17 km SW of Krounovka (130–150 m alt.) nr Chinese bord., S. Primoskij Krai, 28 VII 1990, Sk Yamane, ♀; 40 km SE Chernigovka (250–450 m alt.) S Primoskij Krai, 24 VII 1990, Sk Yamane, 4 ♀; Primoskij Krai, 1 VIII 1986, Lelej, ♂. *Symmorphus captivus* (Smith), Senjugahama Nikko Tochigi, Japan, 2 VIII 1971, H



Figs. 41–47. *Symmorphus lucens*. 41, Tergum I showing weak and sparse punctation. 42, Mesepisternum. 43, Median vertex area. 44, Male antenna. 45, Sternum I showing well developed basal, lateral and medial longitudinal carinae. 46, Lateral face of propodeum. 47, Dorsomedial pit on propodeum.

Itami, ♀; Shinoyama Yamadashi, 5 VI 1978, Y Tanaka, ♂.

Distribution. eastern Europe, east through Siberia, to Kamchatka Oblast, Magandan Oblast, Khabarovsk Krai and Primorskij Krai and the Korean Peninsula

***Symmorphus lucens* (Kostylev) 민잎벌레살이감탕벌 (신칭)**

Odynerus lucens Kostylev, 1938: 23.

Symmorphus lucens (Kostylev): Cumming, 1989: 24, 66–68.

Diagnosis. Cephalic foveal pit slightly smaller than the posterior ocellus, and cephalic fovea and carina absent (Fig. 43). Lateral face of propodeum shiny, and carinate anteriorly and areolate posteriorly (Fig. 46). Basal transverse carina on tergum I strongly developed through the whole width; which is somewhat sinuate dorsally, and in many materials triangularly incised on dorsomedian part (Fig. 41). The last segment of male antenna a little shorter than the preceding segment. Male antenna without distinct tyloid, only with yellow colored weakly swollen portions in the last 4 segments (Fig. 44).

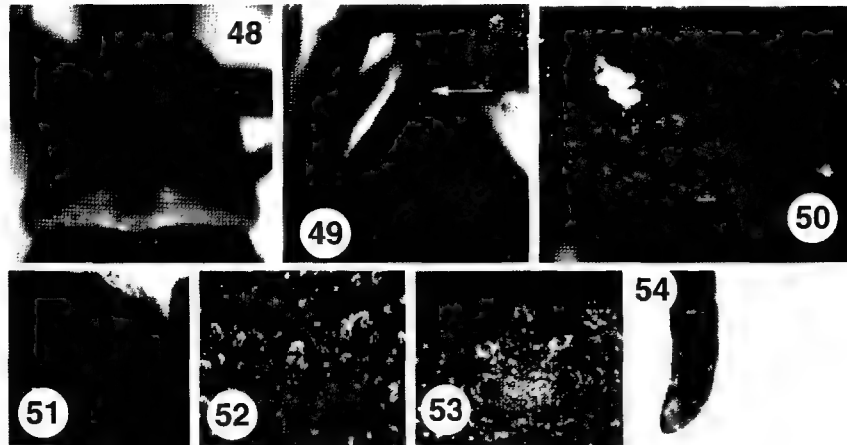
Materials Examined. Korea: GW Mt. Balgyo, Eoron-ri Hongcheon-gun, 23 V 1998, JK Kim, MR Kim, JD Yeo, 5 ♀ 7 ♂; Jingdong-ri, Inje-gun, 24 VIII 1996, P Tripotin, 3 ♀; Mt. Bangtae, Jingdong-ri Inje-gun, 20 VI 1998, JK Kim, ♀. GB Mt. Sudo, Kimcheon-shi, VII 6 1998, JD Yeo, ♀. Specimens other than Korean peninsula: Russia Lazovskij zapovedi, Primorskij Krai, 1983, T Romanikova, 5 ♀ 5 ♂; Isshiki Adachi, Saghalin, 16 VI 1914, ♂. Japan Yokoo (1600 m alt.), nr Kamikochi, Nakano Pref., 30 VII 1967, R Ishikawa, ♀ (Paratype of *S. ishikawai* Giordani Soika, 1975, Kagoshima University).

Distribution. Russia (southern Siberia to Sakhalin), Korea (new record), Japan (Nagano Prefecture).

***Symmorphus bifasciatus* (Linnaeus) 두줄잎벌레살이감탕벌**

Vespa bifasciatus Linnaeus, 1761, Fauna Suec., 2nd. ed., 419 (dating from Cumming 1986)

Symmorphus bifasciatus (Linnaeus): Kurzenko, 1995: 315; Kim and Yoon, 1996: 204.



Figs. 48–54. *Symmorphus bifasciatus*. 48, Tergum I, dorsal view. 49, Sternum I. 50, Mesepisternum. 51, Lateral face of propodeum. 52, Dorsomedial pit on propodeum. 53, Median vertex area with distinct cephalic foveal pit. 54, Male antenna.

Diagnosis. Of the Korean forms the carinal character state of the sternum I as in the key is very unique. Cephalic foveal pit half as large as posterior ocellus (Fig. 53). Cephalic fovea and carina absent. Mesonotum coarse with densely distributed (touching one another) minor punctures (not microscopic) through the entire face and more sparsely distributed major punctures. Posterior half of dorsal and almost entire ventral mesepisternum with large punctures somewhat densely distributed (often touching one another) (Fig. 50). Propodeal shelf wide with a deeply excavated long round medial pit (Fig. 52). Lateral face of propodeum shiny, and distinctly and compactly carinate with large punctures (Fig. 51). Medial longitudinal furrow on tergum I very short, confined to posterior 1/4. Based on Japanese and Russian materials, male antenna with obvious tyloids in the last 4 segments (Fig. 54). The last segment of male antenna almost as long as the preceding segment.

Material Examined. Korea: GW Mt. Hwaak, Sanae Hwacheon-gun, 30 V 1998, JD Yeo ♀; Mt. Bangtae, Jingdong-ri Inje-gun, 20 VI 1998, JK Kim, ♀. Specimens other than Korean peninsula: Japan Ginzan-daira Niigata-ken, Japan, 3 VI 1988, T Onuma, ♀, ♂; Zatoish Hirosaki Aomori, Japan, 29 VI 1983, M Yamada, ♀; Aroshiguchi-Oono, Fukui-ken, Japan, 24 VI 1980, K Kurokawa, ♀. Russia Almaarasan, Jatslsk Altai, 8 VII 1971, NV Kurzenko, ♀.

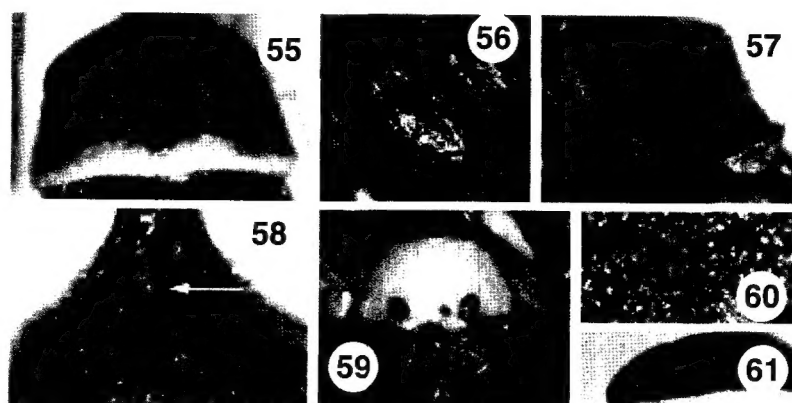
Distribution. Europe, east through Asia, to northeastern Siberia, Korea (new record), Japan.

***Symmorphus tsushmanus* Yamane 대마도잎벌레살이감탕벌 (신칭)**

Symmorphus tsushmanus Yamane, 1990: 128–130.

Diagnosis. Female unknown. Male clypeus transverse, the ratio of width including the lateral lobes/height approximately 1.3 (Fig. 59). Pronotal carina obsolete dorsomedially. Mesepisternum and epimeron with medium-sized punctures, and the punctures on epimeron denser (but not touching one another) (Fig. 56). Basal transverse carina on tergum I strongly developed, and incised triangularly on dorsomedian part. Dorsomedial pit of propodeum small round (Fig. 60). Male antennal segments 10–13 with tyloids (Fig. 61).

Remark. The sole Korean material herein has no apical membraneous process of tergum I



Figs. 55–61. *Symmorphus tsushimanus*. 55, Tergum I, dorsal view. 56, Mesepisternum. 57, Lateral face of propodeum. 58, Sternum I. 59, Clypeus, male. 60, Dorsomedial pit on propodeum. 61, Male antenna.

that Yamane (1990) commented as peculiar characteristics to this species. However we have observed its random appearance in several individuals of the other species. The character seems to be unusual variation, and be of no diagnostic value.

Materials examined. Korea: JN Mt. Jogye, 23 V 1988, Jung, ♂. Specimens other than Korean peninsula: Japan Top of Ariake-san (558 m alt.), Tsushima Is., 4 VII 1975, Y Miyatake, ♂ (Holotype, Collection of Osaka City Museum of Natural History)

Distribution. Korea (southern part, new record), Japan (Tsushima Is.)

***Symmorphus carinatus* Yamane 용골앞벌레살이가탕벌 (신칭)**

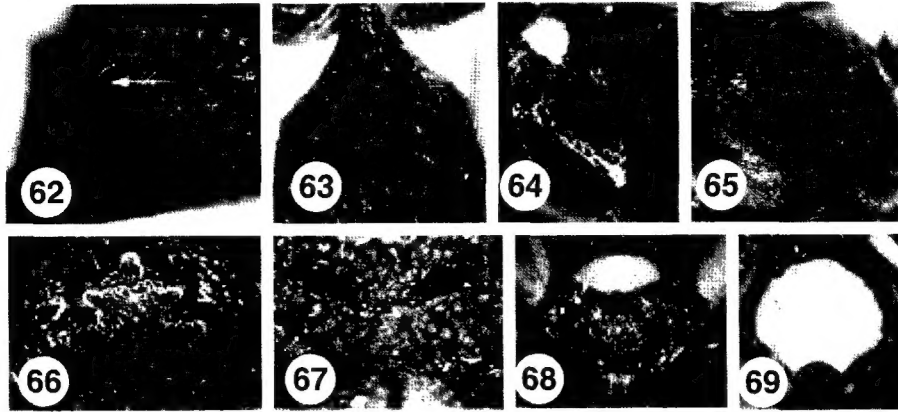
Symmorphus carinatus Yamane, 1990 : 16, 125–126.

Diagnosis. The medial carina on anterior slope area of tergum I is the unique to this species. Cephalic foveal pit small, about a half as large as the posterior ocellus (Fig. 66). Cephalic foveal carina weakly developed. In both sexes, clypeus transverse as in the figures 68 and 69. Mesepisternum shiny with moderately distributed medium-sized punctures (Fig. 65). Medial longitudinal furrow on tergum I short or evanescent, at most confined to posterior 1/4. Lateral face of propodeum with weak but discernable punctures on antero-superior portion widely. Based on Japanese materials, male antenna with obvious tyloids in the last 3 segments. Last segment of male antenna slightly shorter than the preceding segment.

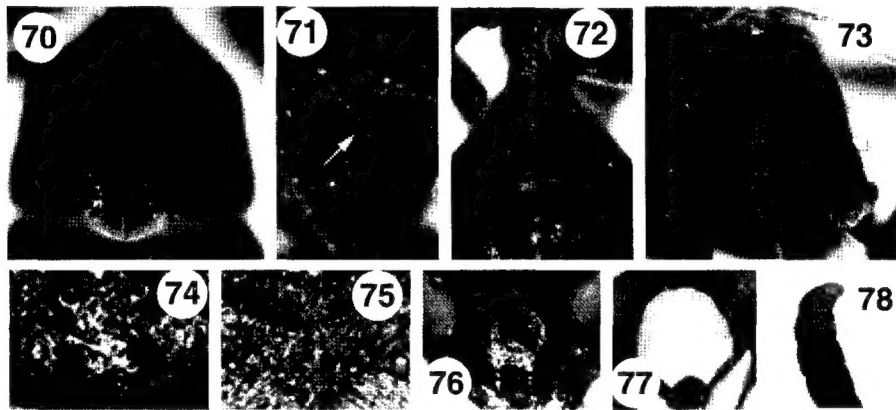
Remark. Although the carinae on anterior slope of tergum I in the two Korean materials herein are weaker than that of Japanese one, they are obvious. With the carina and overall characters comparison with Japanese ones, we came to conclusion that Korean form and Japanese one is conspecific.

Material examined. Korea: GG Kwangleung, 28 V 1972, YJ Yeon, JH Yoo, 2 ♀. Specimens other than Korean peninsula: Japan Kotakaya-yama, Kochi-city, 7 V 1931, Y Sugihara, ♀ (Holotype, Kagoshima University); Emgyoji, Kochi-city, 19 IV 1931, Y Sugihara, ♀ (Paratype, Kagoshima University); Takinosawa (Twd) flow. Angelica, 15 VI 1984, M Yamada, ♂; Hitotsumori (Agzigasawa), Japan, 30 VI 1985, M Yamada, ♂; Zyuhniko (Iwasaki), 2 VI 1989, M Yamada, ♀; Ichinowatari (Hirosaki), Japan, 28 VII 1990, M Yamada, ♀; Mt. Iwaki-CK (Iwaki), Japan, 7 VI 1995, M Yamada, ♂.

Distribution. Korea (new record), Japan (Shikoku).



Figs. 62–69. *Symmorphus carinatus*. 62, Medial carina (arrow) on anterior face of tergum I. 63, Sternum I. 64, Mesepisternum. 65, Lateral face of propodeum. 66, Median vertex area. 67, Dorsomedial pit on propodeum. 68, Clypeus, female. 69, Clypeus, male.



Figs. 70–78. *Symmorphus apiciornatus*. 70, Tergum I, dorsal view. 71, Basal transverse carina on tergum I with a dorsomedial incision. 72, Sternum I. 73, Lateral face of propodeum. 74, Median vertex area. 75, Dorsomedial pit on propodeum. 76, Clypeus, female. 77, Clypeus, male. 78, Male antenna.

***Symmorphus apiciornatus* (Cameron) 꼬마잎벌레살이감탕벌**

Ancistrocerus apiciornatus Cameron, 1911: 288.

Symmorphus apiciornatus (Cameron): Tsuneki, 1986: 27 (♀, Mt. Soyo, Central Korea); Cumming, 1989: 79–81; Kurzenko, 1995: 316; Kim and Yoon, 1996: 204.

Symmorphus seoulensis Tsuneki, 1986: 22–23 (♀, Seoul), synonymized by Cumming 1989.

Diagnosis. Cephalic fovea and carina absent (Fig. 74). Cephalic foveal pit slightly smaller than the posterior ocellus. Clypeus almost as long as wide (Figs. 76 and 77). Almost entire lateral face of propodeum densely striated with very tiny few punctures (Fig. 73). Dorsal mesepisternum shiny, with very sparse and tiny punctures. Medial longitudinal furrow on tergum I present in posterior 1/2 or a little more (but almost 4/5 in one specimen examined

herein) (Fig. 70). The last segment of male antenna very small and short, approximately half as long as the preceding segment (Fig. 74). Male antenna with very evanescent tyloids in the last 4 segments.

Material Examined. Korea: SL "Seiryori" (Cheongryang-ri), 24 V 1928, J Murayama, 2 ♀. GG Kwangneung, 28 V 1972, YJ Yeom, ♀; Mt. Yongmun, 19 V 1973, CH Cho, ♀; Mt. Cheonma, 17 VI 1986, HK Kim, ♂. GW Goseong-gun Jinbu-myeon Jinbu-ri, Jinburyong, 12 VI 1992, JK Kim, ♀; Jingdong-ri Inje-gun, 24 VIII 1996, P Tripotin, 3 ♀ ♀; Mt. Balkyo, Eoron-ri Hongcheon-gun, JK Kim, MR Kim, JD Yeo, 23 V 1998, 7 ♀ ♀, 6 ♂; Mt. Bangtae, Jingdong-ri Inje-gun, 20 VI 1998, JK Kim, 1 ♀; CB Changdae-ri Keumsan, 26 V 1996, P Tripotin, 2 ♀; Taejeon-shi Changdong 2-gu, 7, 9, 24 V 1995, P Tripotin, 5 ♀, ♂; same locality, 9, 10, 12 VI 1996, P Tripotin, 3 ♀. Specimens other than Korean peninsula: Japan Numa Seikikawa, Nigata, Japan, 1 VI 1968, H Itami, ♂; Mt. Makuragi, Shimane Pref., Honshu, Japan, 13 V 1983, H Shimizu, ♀; Yunohana, Aizu Fukushima, Japan, 9 VI 1978, H Itami, ♂.

Distribution. Korea, China (central and eastern), Japan.

Acknowledgements The authors would like to express their cordial thanks to the following persons: Dr. JS Park (Prof., Kyeongsang Nat'l Univ.), Dr. JI Kim (Prof., Sungshin Women's Univ.), Dr. JW Lee (Prof., Yeungnam Univ.) and Mr. P Tripotin for their kind providing of Korean materials, and Dr. Sk Yamane (Prof., Kagoshima Univ., Japan) and Dr. NV Kurzenko (Biology and Pedology Institute, Vladivostok, Russia) for their providing and loaning of foreign materials including some valuable type specimens. One of Authors, JK Kim was supported by JSPS RONPAKU program (ID No. KOSEF-10018).

REFERENCES

- Cameron, P. 1911. Description of three new species of Odynerinae from Japan. *The Entomologist*. 44: 286-287.
- Carpenter, J.M. 1986. A synonymic generic checklist of the Eumeninae (Hymenoptera: Vespidae). *Psyche*. 93: 61-91.
- Cumming, J.M. 1989. Classification and evolution of the Eumenine wasp genus *Symmorphus* Wesmael (Hymenoptera: Vespidae). *Mem. ent. Soc. Can.* 148: 5-168.
- Giordani Soika, A. 1975. Revision dei *Symmorphus* del Giappone. *Boll. Mus. Civ. Stor. Nat. Venez.* 27: 149-161.
- Giordani Soika, A. 1986. Eumenidi palearctici nuovi o poco noti. *Boll. Mus. Civ. Stor. Nat. Venez.* 35: 91-162.
- Kim, C.W. 1970. Illustrated Encyclopedia of Fauna & Flora of Korea Vol. 11 Insecta (III). pp. 545-554. (in Korean)
- Kim, C.W. 1980. Atlas of Insect of Korea. Series 3. Hymenoptera & Diptera. Korea Univ. Press, Seoul, 414pp.
- Kim, J.K. & I.B. Yoon. 1996. Synonymic List and Distribution of Eumenidae (Hymenoptera) in Korean Peninsula. *Entomol. Res. Bull. Suppl. (KEI)*, pp. 197-208.
- Kostylev, G. 1938. Vespidae de la reserve d'Altai Trudy altaisk. *Gos. Zapov.* 1: 301-314. (in Russian and French summary)
- Kostylev, G. 1940. Espèces nouvelles et peu connues de Vespides, Eumenides et Marsarides paléarctique (Hym.). *Bull. Soc. Nat. Moscou. Sect. Biol. (N.S.)* 49: 24-42. (in Russian and French summary)
- Kurzenko, N.V. 1995. Family Eumenidae. In P.A. Lehr (ed.), *Key to the Insects of Russian Far East* 4: 295-324. St. Petersburg, Nauka. (in Russian)
- Linnaeus, C. 1758. *Systema Naturae per Regna Tria Naturae*, (10th Ed.) vol. 1 (Holminae).

- Smith, F. 1873. Descriptions of aculeate Hymenoptera of Japan, collected at Nagasaki and Hiogo. Trans. R. Entomol. Soc. London. 1873: 181–206.
- Tsuneki, K. 1977. Supplements to Giordani Soika's "*Symmorphus* in Japan" (Hymenoptera: Eumenidae). Spec. Publ. Jpn. Hym. Assoc. 5: 12–20.
- Tsuneki, K. 1986. New species and subspecies of the aculeate Hymenoptera from East Asia, with some synonyms, specific remarks and distribution data. Spec. Publ. Jpn. Hym. Assoc. 32: 1–60.
- Vecht, J van der and F.C.J. Fischer. 1972. Palaearctic Eumenidae. Hym. Cat. (nov. ed.), 8: 1–199.
- Vecht, J van der and J.M. Carpenter. 1990. A catalogue of the genera of the Vespidae (Hymenoptera). Zool. Verh. 260: 1–62.
- Yamane, Sk., 1990. A revision of the Japanese Eumenidae (Hymenoptera: Vespoidea). Insecta Matumurana. N.S. 43: 1–189.
- Yasumatsu, K. 1938. The subgenus *Symmorphus* Wesmael of Japan & Corea (Hym.: Eumenidae: Odynerus) Fukuoka Hakubutsugaku Zasshi. 2: 111–116.

(Received: August 15, 2002, Accepted: September 10, 2002)